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## Description

This invention relates to sewing machines. The invention has particular application to sewing required in surgical procedures, and, more particularly, relates to sewing machines which can be used inside the body of a patient without the need to make an external incision in the patient, the machine being controlled externally of the patient, for example by endoscopic means. For convenience such a machine is referred to below as an endoscopic sewing machine, and the ensuing description relates largely to endoscopic sewing machines. It is to be understood, however, that sewing machines according to the present invention could be used in other applications.

GB-A-2050448 describes a sewing machine for forming stitches in a substrate, comprising means defining a slot open towards the substrate for receiving the substrate therein, thread carrying means for passing a thread into the substrate in the slot from one side of the substrate at a first location and for withdrawing the thread from the substrate on the same side at a second location spaced from the first location, the said means being remotely operable solely from the said one side of the substrate.

According to the present invention there is provided a sewing machine of the type just referred to, characterized in that it comprises means for drawing a U-shaped double layer of the substrate into the slot by suction.

The machines according to the present invention open up the possibility of performing a wide range of internal surgical procedures without having to make an external incision in the patient. Potential medical uses of such machines could include the oversewing of bleeding or perforated ulcers, the oversewing of bleeding varices, the narrowing of lax internal anatomical sphincters or organs, the closure of internal holes or fistulae, the assistance in the removal of normal or abnormal tissue, and the attachment of materials or objects to the walls of tissue (for example for attaching gastric tubes for feeding purposes to the wall of the stomach, or for attaching X-ray opaque markers to mark the site of, say, a cancer, or for attaching a piece of material containing a drug to permit localised internal treatment).

Figures 1a, 1b and 1c show a first embodiment of a sewing machine according to the present invention, in three successive stages of operation;

Figure 2 shows, by way of example, one stitch pattern which can be formed by the machine of Figures 1a to 1c;

Figures 3a and 3b are underplan and side elevational views respectively showing a second

embodiment of a sewing machine; and

Figures 4a to 4h show diagrammatically the second embodiment of sewing machine in successive stages of operation, each Figure comprising two longitudinal sections through mutually perpendicular planes, in order to enable the operation of the machine to be more easily visualised in three dimensions, one of the longitudinal sections in each Figure being taken along the section line indicated in the other.

The embodiment shown in Figures 1a to 1c comprises a block 1 preferably formed of a transparent material, such as perspex. A slot 2 is formed in the block 1, the slot extending from the front to the back of the block, i.e. in a direction perpendicular to the plane of the paper. The block also has two longitudinal channels 3 and 4 formed therein. The channel 3 receives a needle 5 which is longitudinally slidable in the channel 3 under the control of a control wire 6. The needle 5 has a head portion 7 in which is formed an eye 8, and a thread 9 to be used in sewing is passed through the eye 8. The channels 3 and 4 are continuous with corresponding channels 17 and 18 formed in a two-channel endoscope tube 19.

The block 1 also has a compartment 10 formed therein, distal to the slot 2. A shoe 11 is mounted in the compartment 10. The rear portion 13 of the shoe 11 is resilient and serves to bias the shoe in an anti-clockwise direction into the position shown in Figure 1a. A hook 14 is mounted on the shoe 11 by means of a pin 12 for pivotal movement on the pin 12. The hook 14 is approximately in the shape of a V, and a control wire 15, which passes down the channels 4 and 18, is attached to the hook 14 adjacent the vertex of the V. A source of suction (not shown) is connected to the proximal end of channel 18 for a purpose which will be described below.

Turning now to the operation of the machine, the initial position is shown in Figure 1a, with the machine positioned above a layer of tissue 16 in which it is desired to form stitches. Suction is then applied to the slot 2 to suck into the slot a U-shaped double layer of tissue, as can be seen in Figure 1b. The depth of the slot 2 controls the amount of tissue which is sucked in. The needle 5 is then forced forwards through the double layer of tissue, as is also shown in Figure 1b. The needle carries with it the loop of thread 9. The tip of the needle strikes the shoe 11 which is thereby caused to pivot downwardly against the biasing force of the shoe portion 13. The control wire 15 is then pulled rightwardly to cause the hook 14 to pivot and thereby catch the loop of thread carried by the eye 8 of the needle 5. This can also be seen in Figure 1b. It should be mentioned at this point that the side of the head portion 7 of the needle has a

groove (not shown) formed therein to allow the hook 14 to pass between the head portion 7 and the thread carried thereby.

As shown in Figure 1c the needle is then withdrawn leaving the loop of thread held between the hook 14 and the shoe 11. The suction applied to the slot 2 is then released and the double layer of tissue leaves the slot. This is also shown in Figure 1c, from which it can be seen that the effect of the steps described above is to pass a loop of thread from one side of the tissue through the tissue at a first location and back out of the tissue on the same side at a second location from the first location. As will be appreciated, this has been done without requiring access to the opposite side of the tissue which one would expect to be inaccessible under normal circumstances.

The machine is then moved to the site of the next stitch, suction is re-applied and the needle passes through a double layer of tissue at a different point. It is possible to form a variety of different stitches using the machine, but one example is shown diagrammatically in Figure 2. This stitch pattern is formed by moving the machine between successive stitches in a direction perpendicular to the plane of the paper in the drawings of Figure 1a to 1c. Figure 2 is a view taken looking down on the upper surface of the tissue shown in Figures 1a to 1c, and it will be seen that each of the loops formed by the hook 14 and the shoe 11 passes through the preceding such loop. How this is achieved can be understood by imagining the effect of moving the needle forwardly from the position shown in Figure 1c, with suction re-applied to the slot 2 to suck the tissue into the slot. It will be appreciated that the forward end of the needle will pass through the loop of thread caught between the hook 14 and the shoe 11, carrying a new loop of thread with it. It should be mentioned that to assist this process a small groove can be formed in the upper surface of the shoe, up which the tip of the needle can slide. This enables the needle to pass under the loop of thread already caught between the hook and shoe, without the risk that the needle may simply push the existing loop further up the surface of the shoe. Once the needle has placed the second loop through the first loop the hook 14 is pivoted to allow the first loop to be cast off by pulling on the tail of the thread. The hook 14 is then pivoted downwardly again, so that when the needle is withdrawn the second loop of thread is caught thereby.

As already mentioned, the body 1 is preferably made of a transparent material, so as to make it easier for the operator to see, and hence control, the operation of the machine. The control mechanisms can pass down the channel of an existing endoscope, or the machine can be used indepen-

dently with a small supervising endoscope passed in parallel with the control channel of the machine.

The embodiment shown in Figures 3a and 3b is modular in construction, and comprises modules A to G joined face to face and held in position by suitable means, for example, a pair of longitudinally extending bolts passing through aligned bores in the individual modules. In the embodiment illustrated the modules B and D are formed of a transparent material and the remaining modules are not, but others of the modules may be transparent, and indeed it is preferable for some purposes that at least the module A should be transparent.

The module A is the main body portion, and defines longitudinal channels 103 and 104, corresponding to the channels 3 and 4 shown in Figure 1. The channel 103 receives a needle 105, which is longitudinally slidable therein under the control of a control wire 106. The needle 106 has a head portion in which is formed an eye 108 and a thread to be used in sewing is passed through the eye. The channels 103 and 104 are continuous with corresponding channels 117 and 118 formed in a two-channel endoscope tube, the rest of the endoscope being omitted for simplicity in Figures 3a and 3b.

The module B has a slot 102 formed therein, which, as viewed in underplan view, extends across the central region of the module B and which, as viewed in elevation, extends from the top of the module to a location falling just short of the bottom.

The module B is separated by module C, which constitutes a spacer disc and which has an aperture 150 therein through which the needle 105 can pass, from the module D. Module D has a compartment 110 therein which is aligned with slot 102 in module B.

Modules E and F retain a pin 112 on which a U-shaped member 111 is pivotally mounted. The arms of the member 111 each carry a respective resilient wire 151. As can be seen in Figure 3a, the wires converge towards one another at their tips as viewed in underplan, and, as can be seen in Figure 3b, the tip portions of the wires are bent upwardly and one of the wires is longer than the other and thus extends further upwards than does the other.

A control wire 115, which passes down the channels 118 and 104 is attached to an arm 152 which is, in turn, rigidly connected to the U-shaped member 111.

The module G provides a curved or bevelled front end to the device, so as to increase the ease with which it can be introduced into a patient.

A source of suction (not shown) is connected to the proximal end of the channel 118 for a purpose which will be described in more detail below and which is basically similar to that for which the source of suction is used in the embodi-

ment of Figure 1.

The operation of the device of Figures 3a and 3b will now be described with reference to Figures 4a to 4h. It should be noted that these figures are diagrammatic in character. In each case module G has been omitted, and the modular construction of the remaining portion of the device has not been shown in detail.

The initial position is shown in Figure 4a with the machine positioned above a layer of tissue 116 in which it is desired to form stitches. Suction is then applied to the slot 102 via the channel 104 to suck into the slot a double layer of tissue, as can be seen in Figure 4b. The depth and width of the slot 102 controls the amount of tissue which is sucked in. The modular design of this embodiment makes it possible to vary the amount of tissue sucked in, and hence vary the size of the stitches, simply by removing module B and replacing it by a module having a different thickness or depth of slot.

The needle 105 is then forced forwards through the double layer of tissue, as shown in Figure 4c. The needle carries with it a loop of a thread 109. The needle passes behind the upwardly extending tip portions of both of the wires 151, as viewed in Figure 4c. The control wire 115 is then pushed leftwards, as shown in Figure 4c, to cause the U-shaped member 111 to pivot anti-clockwise and thus to cause the outer ends of the wires 151 to pass upwardly on the same side of the needle and through the loop of thread carried by the eye of the needle 105, that is to say, the wires pass between the needle and one of the runs of the thread to catch the same. The needle 105 is then withdrawn rightwards whilst the U-shaped member is rotated fully anti-clockwise carrying the thread upwards into the compartment 110. This is shown in Figure 4d. This last action forms the thread into a large diameter loop. This results from the fact that the wires 151 diverge from one another as considered in a direction running leftwardly from their tips.

The suction applied to the slot 102 is then released and the double layer of tissue, with the thread 109 passing through it, leaves the slot. This is also shown in Figure 4d.

The machine is then moved with respect to the tissue in any direction to the right of a plane drawn perpendicular to the plane of the paper and passing through the machine.

Thus, the machine could be moved rightwardly in a direction parallel to its length, or at any angle less than 90° with respect to the aforesaid direction. The step shown in Figure 4e is then carried out, that is to say, suction is re-applied and the needle caused to pass through a double layer of tissue at a different point to that where the needle passed through the tissue in step 4c. As can be seen in

Figure 4e, the forward end of the needle passes through the loop of thread already held by the U-shaped member 111, carrying a second loop of thread with it. Once the needle has placed this second loop through the first loop, the U-shaped member is pivoted clockwise, as shown in Figure 4f. The wires 151, being resilient, are forced apart by the needle and thus pass one on either side of the needle as the U-shaped member 111 travels to the position shown in Figure 4f, in which it is below the needle. In so doing the wires 151 drop the first loop onto the second loop.

The member 111 is then pivoted anti-clockwise, as shown in Figure 4g, so as to catch the second loop carried by the eye of the needle. This is shown in Figure 4g. Both wires 151 at this stage lie against the needle 102 and between the needle 102 and the adjacent portion of the thread 109.

As shown in Figure 4h, the needle 102 is then withdrawn rightwardly and the member 112 is pivoted further in an anti-clockwise direction, carrying the second loop upwards with it. As also shown in Figure 4h, the suction is then released to allow the tissue to leave the slot 102.

The above procedure is repeated as many times as are necessary in order to produce the desired number of stitches.

Various modifications may be made to the embodiments described above. One of these is that the machine can be provided with a plurality of slots 2 into each of which a double layer of tissue may be sucked. A single needle can then pass through each of these double layers of tissue, thus making a plurality of stitches in a single operation. Also, it should be understood that the stitch forming part of the machine could be modified to correspond to that of any one of a number of conventional sewing machines. For example, the stitching mechanism could be one which uses two threads, rather than one as in the illustrated embodiments.

As mentioned above, the module A is preferably transparent. This is to make it easier for the operator to see, and hence control the operation of the machine. Visibility may further be improved, both in the embodiment of Figures 3 and 4 and in the embodiment of figure 1, by positioning a mirror in the slot 102 (or slot 2) at 45° to the longitudinal axis of the machine. By way of example this is shown diagrammatically as 153 in Figure 3b. This enables the user to see the double layer of tissue sucked into the slot 2. A still further improvement can be achieved by extending the endoscope optics right up to the slot 102 (or 2).

## Claims

1. A sewing machine for forming stitches in a

substrate (16, 116), comprising means defining a slot (2, 102) open towards the substrate (16, 116) for receiving the substrate therein, thread carrying means (5, 105) for passing a thread (9, 109) into the substrate in the slot from one side of the substrate at a first location and for withdrawing the thread from the substrate on the same side at a second location spaced from the first location, the said means being remotely operable solely from the said one side of the substrate, characterized in that it comprises means (18, 118) for drawing a U-shaped double layer of the substrate into the slot (2, 102) by suction.

2. A machine according to claim 1, wherein the thread-carrying means (5, 105) is arranged for movement from a retracted position to an extended position, in which movement it carries a loop of thread into and through the said double layer and further comprising means (11, 14; 111) for catching the said loop after it has been passed through the said double layer and holding the said loop while the thread-carrying means (5, 105) is withdrawn to the retracted position.
3. A machine according to claim 2, wherein the catching means (11, 14; 111) is movable from a catching position to a position in which the loop caught is positioned so that subsequent movement of the thread-carrying means (5, 105) from said retracted position to said extended position carries a further loop of thread through the previously caught loop.
4. A machine according to any preceding claim, comprising a channel (18, 118) communicating with said slot for supplying the suction thereto to effect the said drawing in of the double layer.
5. A machine according to claim 4, as dependent on claim 2 or 3, comprising a block (1) having distal and proximal ends, the block (1) defining a compartment (10, 110) adjacent the distal end housing the catching means (11, 14; 111), said slot (2, 102) being defined in the block on the proximal side of the compartment, said suction-supplying channel (18, 118) being defined in the block on the proximal side of the slot, a further channel (17, 117) being defined on the proximal side of the slot and communicating with the slot, said thread-carrying means (5, 105) being slidably received therein for movement between said retracted position, in which the thread-carrying means is substantially wholly within said further channel, and

said extended position, in which the thread-carrying means extends across said slot (2, 102) into said compartment (10, 110).

6. A machine according to claim 5, wherein control means (15, 115) for controlling the catching means extend through the suction-supplying channel (18, 118) and across said slot (2, 102) into said compartment (10, 110) to connect with the catching means (11, 14; 111).
7. A machine according to claim 6, wherein said control means (15, 115) comprises a flexible wire, and wherein the machine further comprises a further flexible wire (6, 106) for moving the thread-carrying means (5, 105) between the retracted and extended positions.
8. A machine according to claim 6 or 7, wherein the catching means comprises a shoe (11) resiliently mounted in the compartment for pivotal movement about an axis transverse to the length of the block (1), and a hook (14) pivotally mounted at one end on the shoe and movable by said control means (15) between a position in which the other end thereof is in contact with the shoe and a position in which there is no such contact.
9. A machine according to claim 6 or 7, wherein the catching means comprises a pair of arms defining a U, the U-shaped member (111) being mounted in the compartment for pivotal movement about an axis transverse to the length of the block and a pair of resilient members (151) each extending from a respective one of said arms, the resilient members converging towards one another adjacent the outward ends thereof, the U-shaped member (111) being movable by said control means (115) between an outward position in which, when the thread-carrying means (105) is in its extended position both resilient members (151) are closely adjacent the thread-carrying means on the same side thereof, and an inward position in which the resilient members are located inwardly of the thread-carrying means.
10. A machine according to any of claims 5 to 9, wherein the block is formed of a plurality of disconnectible modules (A-G) located face to face, one of said modules being a module (B) defining said slot.
11. A machine according to any of claims 5 to 10, wherein proximally of the slot the block is transparent.

12. A machine according to any of claims 5 to 11, further comprising a mirror (153) located in the said slot and angled with respect to a line extending between the proximal and distal ends of the block.

13. A machine according to any preceding claim, mounted on an end of an endoscope.

#### Revendications

1. Machine à coudre destinée à former des points dans un substrat (16, 116), comprenant des moyens qui définissent une fente (2, 102) qui s'ouvre vers le substrat (16, 116) pour recevoir intérieurement le substrat, des moyens porte-fil (5, 105), servant à enfiler un fil (9, 109) dans le substrat contenu dans la fente, à partir d'un côté du substrat, en un premier emplacement, et pour tirer le fil du substrat sur le même côté, en un deuxième emplacement espacé du premier emplacement, lesdits moyens pouvant être commandés à distance, en agissant seulement à partir dudit premier côté du substrat, caractérisée en ce qu'elle comprend des moyens (18, 118) servant à attirer une double couche du substrat repliée en U dans la fente (2, 102) par aspiration.

2. Machine selon la revendication 1, dans laquelle les moyens porte-fil (5, 105) sont agencés pour se déplacer d'une position rétractée à une position d'extension, mouvement dans lequel ils transportent une boucle de fil dans et à travers ladite double couche, la machine comprenant en outre des moyens (11, 14 ; 111) servant à prendre ladite boucle après qu'elle a été passée à travers ladite double couche et à retenir ladite boucle pendant que les moyens porte-fil (5, 105) sont ramenés à la position rétractée.

3. Machine selon la revendication 2, dans laquelle les moyens de prise (11, 14 ; 111) peuvent se déplacer d'une position de prise à une position dans laquelle la boucle prise est positionnée de telle manière que le mouvement suivant des moyens porte-fil (5, 105), de ladite position rétractée à ladite position d'extension, transportent une nouvelle boucle de fil à travers la boucle prise précédemment.

4. Machine selon une quelconque des revendications précédentes, comprenant un conduit (18, 118) qui communique avec ladite fente pour lui transmettre l'aspiration afin d'effectuer ladite aspiration de la double couche.

5. Machine selon la revendication 4, rattachée à la revendication 2 ou 3, comprenant un bloc (1) qui présente des extrémités distale et proximale, le bloc (1) définissant un compartiment (10, 110) adjacent à l'extrémité distale et qui renferme les moyens de prise (11, 14 ; 111), ladite fente (2, 102) étant définie dans le bloc, sur le côté proximal du compartiment, ledit conduit (18, 118) de transmission de l'aspiration étant défini dans le bloc sur le côté proximal de la fente, un autre conduit (17, 117) étant défini sur le côté proximal de la fente et communiquant avec la fente, lesdits moyens porte-fil (5, 105) étant logés coulisants dans ce conduit pour se déplacer entre ladite position rétractée, dans laquelle les moyens porte-fil sont sensiblement entièrement contenus dans ledit autre conduit, et ladite position d'extension, dans laquelle les moyens porte-fil traversent ladite fente (2, 102) pour pénétrer dans ledit compartiment (10, 110).

6. Machine selon la revendication 5, dans laquelle des moyens de commande (15, 115) servent à commander les moyens de prise passant dans le conduit (18, 118) de transmission de l'aspiration et traversant ladite fente (2, 102) pour pénétrer dans ledit compartiment (10, 110) pour coopérer avec les moyens de prise (11, 14 ; 111).

7. Machine selon la revendication 5, dans laquelle lesdits moyens de commande (15, 115) comprennent un fil flexible, et dans laquelle la machine comprend en outre un autre fil flexible (6, 106) servant à déplacer les moyens porte-fil (5, 105) entre la position rétractée et la position d'extension.

8. Machine selon la revendication 6 ou 7, dans laquelle les moyens de prise comprennent un sabot (11) monté élastiquement dans le compartiment pour pivoter autour d'un axe transversal à la longueur du bloc (1), et un crochet (14) monté pivotant à une extrémité du sabot et qui peut être déplacé par lesdits moyens de commande (15) entre une position dans laquelle son autre extrémité est en contact avec le sabot, et une position dans laquelle ce contact n'existe pas.

9. Machine selon la revendication 6 ou 7, dans laquelle les moyens de prise comprennent deux bras formant un U, l'élément (111) en forme de U étant monté dans le compartiment pour pivoter autour d'un axe transversal à la longueur du bloc, et deux éléments élastiques (151) dont chacun fait saillie sur l'un, respectif,

desdits bras, les éléments élastiques convergeant l'un vers l'autre dans la région de leurs extrémités extérieures, l'élément en forme de U (11) pouvant être déplacé par lesdits moyens de commande (115) entre une position extérieure, dans laquelle, lorsque les moyens porte-fil (105) sont dans leur position d'extension, les deux éléments élastiques (151) sont étroitement adjacents aux moyens porte-fil du même côté de ceux-ci, et une position intérieure, dans laquelle les éléments élastiques sont placés à l'intérieur par rapport aux moyens portefil.

10. Machine selon une quelconque des revendications 5 à 9, dans laquelle le bloc est formé d'une pluralité de modules séparables (A-G) placés face à face, l'un desdits modules étant un module (B) qui définit ladite fente.
11. Machine selon une quelconque des revendications 5 à 10, dans laquelle le bloc est transparent dans la zone proximale par rapport à la fente.
12. Machine selon une quelconque des revendications 5 à 11, comprenant en outre un miroir (153) placé dans ladite fente et incliné par rapport à une ligne qui s'étend entre les extrémités proximale et distale du bloc.
13. Machine selon une quelconque des revendications précédentes, montée sur une extrémité d'un endoscope.

#### Patentansprüche

1. Nähmaschine zur Bildung von Stichen in einem Substrat (16, 116), mit Mitteln, die einen in Richtung auf das Substrat (16, 116) offenen Schlitz (2, 102) zur Aufnahme des Substrats darin bilden, mit Fadentragsmitteln (5, 105) zum Durchführen eines Fadens (9, 109) in das Substrat in dem Schlitz von einer Seite des Substrats an einer ersten Stelle und zum Zurückziehen des Fadens von dem Substrat auf der gleichen Seite an einer zweiten Stelle mit Abstand von der ersten Stelle, wobei die Mittel fernbetätigbar nur von der einen Seite des Substrats sind, dadurch gekennzeichnet, daß sie Mittel (18, 118) zum Ziehen einer U-förmigen doppelten Lage des Substrates in den Schlitz (2, 102) durch Ansaugen aufweist.
2. Maschine nach Anspruch 1, bei der das Fadentragsmittel (5, 105) zur Bewegung aus einer zurückgezogenen Position in eine gestreckte Position angeordnet ist, bei welcher

Bewegung es eine Fadenschleife in und durch die doppelte Lage trägt, und wobei sie weiterhin Mittel (11, 14; 111) zum Fangen der Schleife, nachdem sie durch die doppelte Lage hindurchgegangen ist, und zum Halten der Schleife aufweist, während das Fadentragsmittel (5, 105) in die zurückgezogene Position zurückgezogen wird.

3. Maschine nach Anspruch 2, bei der die Fangmittel (11, 14; 111) aus einer Fangposition in eine Position bewegbar sind, in der die gefangene Schleife derart positioniert ist, daß eine anschließende Bewegung des Fadentragsmittels (5, 105) aus der zurückgezogenen Position in die ausgestreckte Position eine weitere Fadenschleife durch die vorher gefangene Schleife trägt.
4. Maschine nach einem vorhergehenden Anspruch, enthaltend einen mit dem Schlitz in Verbindung stehenden Kanal (18, 118) zur Lieferung des Ansaugens an diesen zur Bewirkung des Einziehens der doppelten Lage.
5. Maschine nach Anspruch 4, sofern von Anspruch 2 oder 3 abhängig, mit einem Block (1) mit einem distalen und proximalen Ende, der ein Abteil (10, 110) benachbart dem distalen Ende und die Fangmittel (11, 14; 111) beherbergend bildet, wobei der Schlitz (2, 102) in dem Block an der proximalen Seite des Abteils gebildet ist, der Ansauglieferungskanal (18, 118) in dem Block an der proximalen Seite des Schlitzes gebildet ist, ein weiterer Kanal (17, 117) an der proximalen Seite des Schlitzes und mit dem Schlitz in Verbindung stehend gebildet ist, wobei das Fadentragsmittel (5, 105) gleitend darin aufgenommen ist zur Bewegung zwischen der zurückgezogenen Position, in der das Fadentragsmittel im wesentlichen vollständig innerhalb des weiteren Kanals ist, und der ausgestreckten Position, in der das Fadentragsmittel sich durch den Schlitz (2, 102) in das Abteil (10, 110) erstreckt.
6. Maschine nach Anspruch 5, bei der Steuermittel (15, 115) zur Steuerung der Fangmittel sich durch den Ansauglieferungskanal (18, 118) und quer durch den Schlitz (2, 102) in das Abteil (10, 110) zur Verbindung mit den Fangmitteln (11, 14; 111) erstrecken.
7. Maschine nach Anspruch 6, bei der die Steuermittel (15, 115) einen flexiblen Draht enthalten und die Maschine weiterhin einen weiteren flexiblen Draht (6, 106) zur Bewegung der Fadentragsmittel (5, 105) zwischen der zurückgezo-

genen und der ausgefahrenen Position enthält.

8. Maschine nach Anspruch 6 oder 7, bei der die Fangmittel einen nachgiebig in dem Abteil zur Schwenkbewegung um eine quer zur Länge des Blockes (1) verlaufende Achse angeordneten Schuh (11) umfassen sowie einen an einem Ende an dem Schuh schwenkbar befestigten und von den Steuermitteln (15) zwischen einer Position, in der sein anderes Ende in Kontakt mit dem Schuh, und einer Position, in der es keinen solchen Kontakt gibt, bewegbaren Haken (14) enthält. 5 10
9. Maschine nach Anspruch 6 oder 7, bei der die Fangmittel ein Paar von ein U bildenden Armen enthalten, das U-förmige Element (111) in dem Abteil zur Schwenkbewegung um eine Achse quer zur Länge des Blocks angeordnet ist sowie ein Paar von nachgiebigen Elementen (151), das sich jeweils von einem der Arme erstreckt, die nachgiebigen Elemente aufeinander zu im Bereich ihrer äußeren Enden konvergieren, das U-förmige Element (111) von den Steuermitteln (115) zwischen einer äußeren Position, in der, wenn das Fadentragemittel (105) in seiner ausgestreckten Position ist, beide nachgiebigen Elemente (151) eng benachbart zu dem Fadentragemittel auf der gleichen Seite von diesem sind, und einer inneren Position bewegbar ist, in der die nachgiebigen Elemente innerhalb der Fadentragemittel angeordnet sind. 15 20 25 30
10. Maschine nach einem der Ansprüche 5 bis 9, bei der der Block aus einer Vielzahl von voneinander lösbaren Modulen (A-G) gebildet ist, die Seite an Seite angeordnet ist, wobei eines der Module ein Modul (B) ist, das den Schlitz bildet. 35 40
11. Maschine nach einem der Ansprüche 5 bis 10, bei dem der Block auf der proximalen Seite des Schlitzes transparent ist. 45
12. Maschine nach einem der Ansprüche 5 bis 11, weiterhin enthaltend einen in dem Schlitz angeordneten Spiegel (153), der unter einem Winkel gegenüber einer Linie verläuft, die sich zwischen dem proximalen und dem distalen Ende des Blockes erstreckt. 50
13. Maschine nach einem vorhergehenden Anspruch, befestigt an einem Ende eines Endoskops. 55



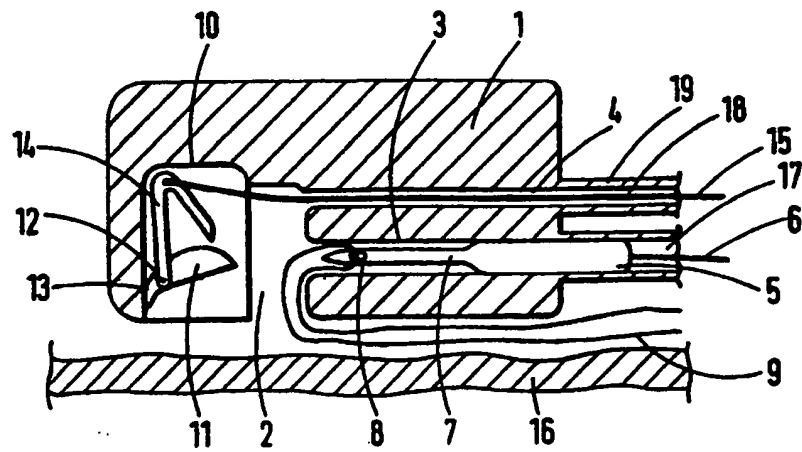


Fig.1a

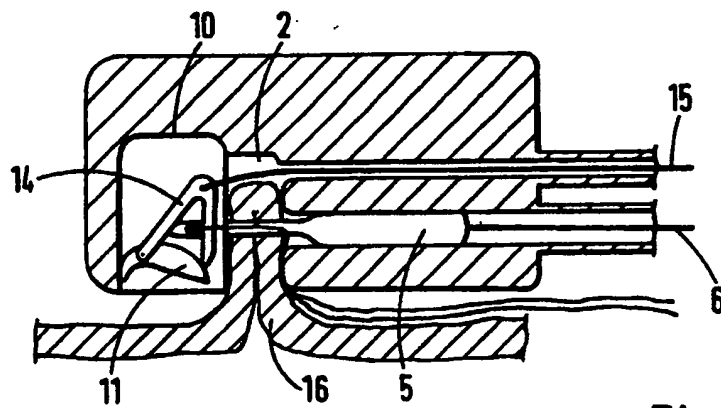


Fig.1b

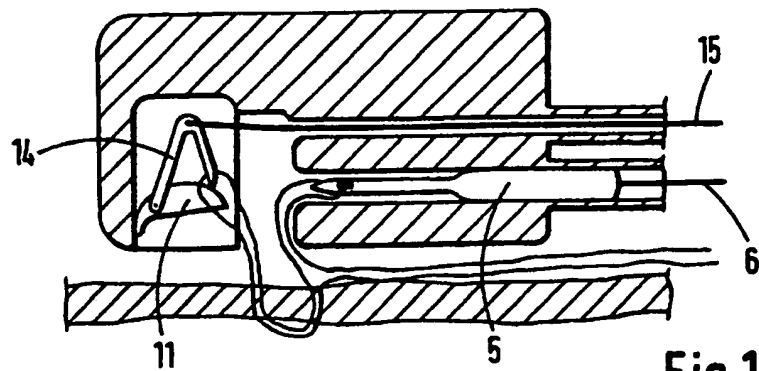


Fig.1c

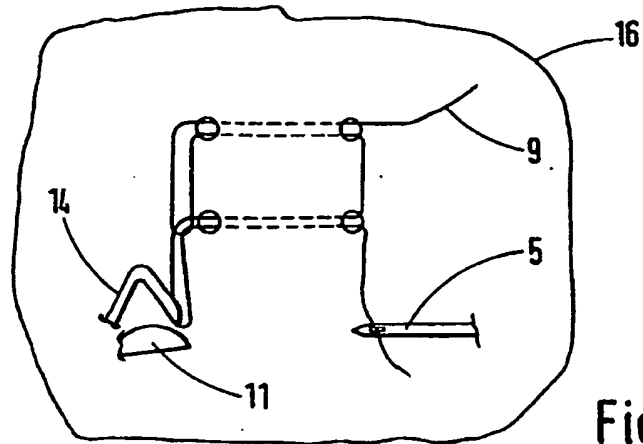


Fig.2

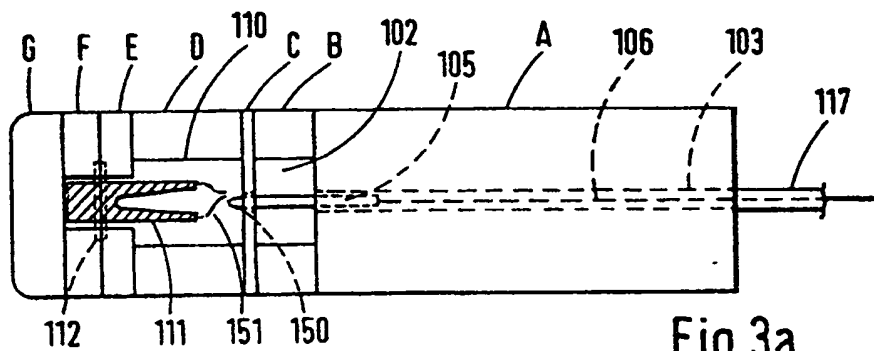


Fig.3a

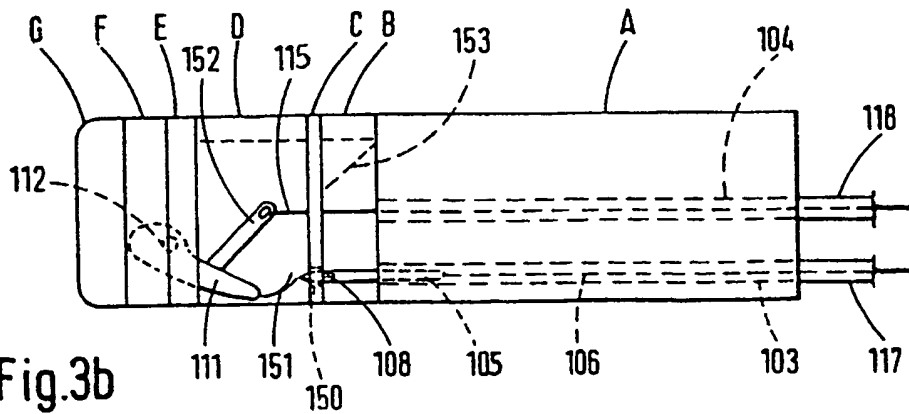
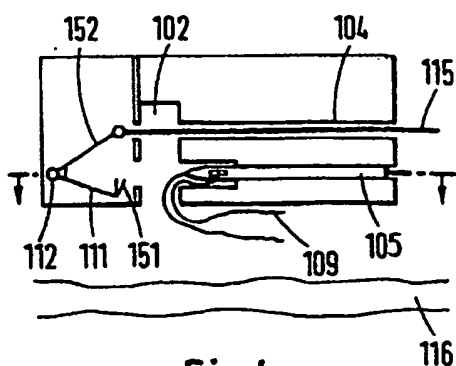
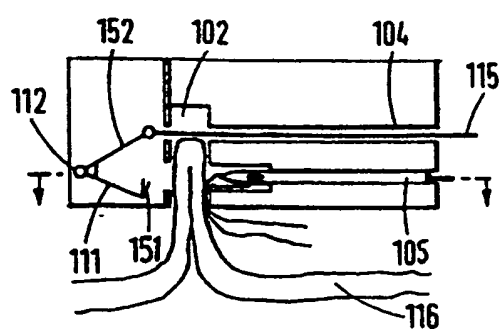
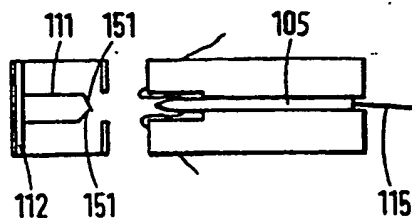


Fig.3b



**Fig.4a**



**Fig.4b**

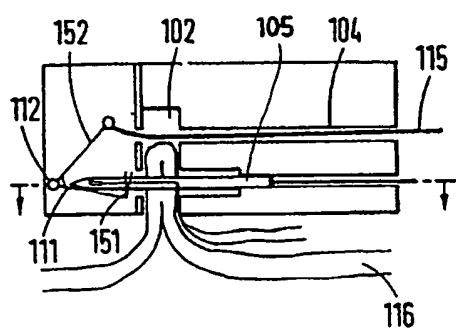
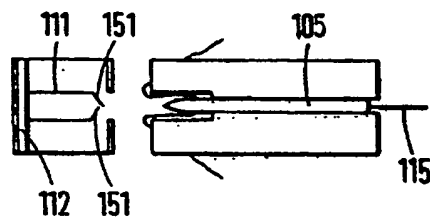


Fig.4c

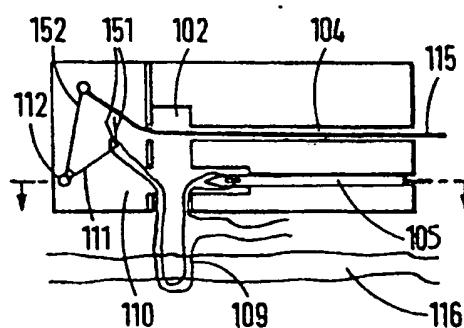
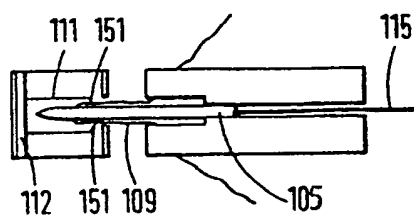
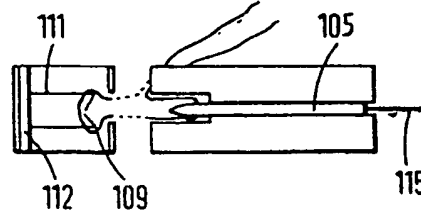


Fig.4d



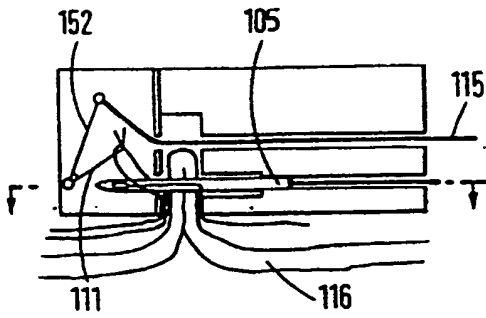


Fig.4e

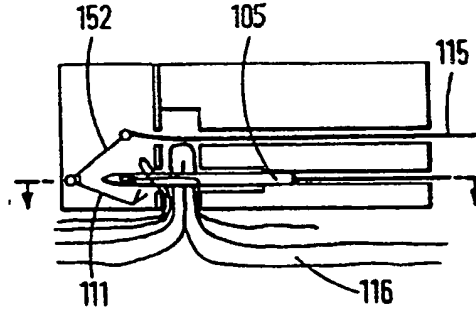


Fig.4f

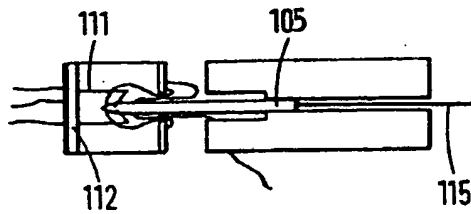


Fig.4g

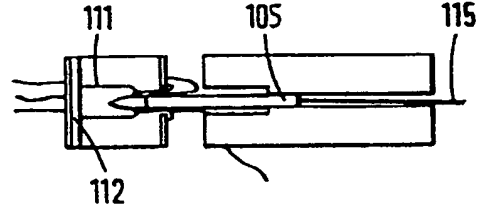


Fig.4h

